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Master in

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Mobile programming report

Social VeGarden

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Chapter 1

Introduction

In recent years we increasingly feel the need to share what we do with others. However, if we have a niche interest, it is difficult to find someone with whom we can compare ourselves. Fortunately, on the Internet it is normal to exchange ideas and solutions even with people we do not know.

Some of the growing trends in last years are vegetable-based diets [1] and biological food [2], hence more people get interested in making their own vegetable garden. On internet it's not easy to find reliable information because of the paradox of choice. People trust other people and not unknown websites.

In this project I try to develop a very basic social network for vegetable gardens where the users can interact in a similar way as they already do with "general purpose" social networks. It also includes some features that are specifically developed for vegetable gardens.

Chapter 2

App Design

In this chapter it will be showed who is the target users of the application, their characteristics, what is the navigation flow of the user in the app. Finally, a paper prototype will be drawn in order to get an idea of the look and feel of the application.

2.1 User profile

Since the app is aimed at a quite large audience, the cognitive style and attitude are heterogeneous. In fact, it could be used by both computer-savvy and educated people as well as inexperienced people. User motivation is medium because there are other social networks but not with specific characteristics for vegetable gardens. The literacy level is assumed to be medium. The native language could be any since it is not a country-specific app. It is probable that the users use the app frequently during spring and summer but they don't use it at all during winter and fall. Therefore, the task experience of the user may vary during the period of the year. The app is not aimed at children, but it is reasonable to assume that the age of users could range between 16 and 70 years old. There is no need for a training phase and manuals, because it should be a walk-up-and-use app. The app could be used in different places, but it is likely to think that it is often used near the vegetable garden, perhaps even when the user is working on it and also using other tools.

2.2 Interviews

Before starting to think about the design of the app I interviewed two people that may be interested in it. It is a structured interview.

2.2.1 First interview

Hello Paolo, how are you?

Hi, I'm fine thanks!

Do you have a vegetable garden?

Yeah, my vegetable garden is pretty small, just 20 m² but I love spending time working in it. Furthermore during summer I always eat biological vegetable basically for free.

How did you learn to garden?

My grandfather were a farmer and he taught me everything I know.

I'm developing an app that let the users exchange ideas and suggestions about vegetable gardens. It will be something like Instagram, but with specific features for vegetable gardens. What do you think about this?

Wow, I've never heard about something like this. I think it could be very interesting if well developed. I would love to know more from experienced farmers.

What are the features that you expect from this app?

Well, I'm very familiar with games where you have a farm, vegetable to harvest, and do other things... do you understand? I will like to have a profile page where I can show others the digital representation of my garden and I can interact with it in a similar way as in farm games.

2.2.2 Second interview

Hello Sara, how are you?

Hello Damiano, I'm good!

Do you have a vegetable garden?

Yes, me and my mum during summer always do it together. I think it is time well spent.

How did you learn to garden?

Everything started as a challenge. My mother thought I couldn't do it for more than a month, but here we are! At first we didn't know anything about gardening, then when new problems arose we searched on the Internet and tried. Year after year things have improved, it's just a matter of experience.

I'm developing an app that let the users exchange ideas and suggestions about vegetable gardens. It will be something like Instagram, but with specific features for vegetable gardens. What do you think about this?

Nice! Can I already try it? I think it could be interesting to have a virtual place where we can find information and also helping others!

What are the features that you expect from this app?

I like to take pictures of plants and watch them grow day by day. I expect to be able to upload them so that everyone can see what I am doing and give me feedback.

2.3 Personas

2.3.1 Persona 1: Sophia Anderson

Name and surname	Sophia Anderson
Age	44
Job	Teacher
Hobby	Gardening and reading novels
Degree	Master's degree

Sophia is a teacher in a primary school, she loves nature and, as soon as the spring begins, she brings her students to the wild, woods, or to the zoo. When she comes back home, Sophia needs silence and in order to regenerate herself cultivates her vegetable garden. Her favorite vegetables are tomatoes, eggplants and peppers. Sophia lives alone and so she has always a lot of extra vegetables during the summer and so she often gives crops to her friends. He loves to hear compliments from them.

2.3.2 Persona 2: Jackson family

Name and surname	Paul Jackson and Lisa Moore
Age	35 and 33
Job	Software engineer and clinician
Hobby	Travel
Degree	College degree

Paul and Lisa married five years ago, since then they decided to also begin a healthy lifestyle including a vegetable-based diet. In their new house there is a little space where they decided to start a vegetable garden. When they started they felt frustrated because they knew nothing about gardening and none of their friend could help because they don't have a vegetable garden. Now after many mistakes they are a little bit more experienced but would love to know someone who helps them when their crops get parasites.

2.4 Scenario

2.4.1 Scenario 1: Sophia Anderson

Sophia has had a vegetable garden since she was a child. Her parents taught her how to cultivate and so she has a lot of experience. Her vegetable garden is very large, almost 150 m² and she can cultivate a lot of crops but it also takes a lot of her free time. When she go to school she brings a lot of vegetables to other teachers and she loves to hear their compliments. Sophia is very good at teaching and she would love to use a platform where she can share what she do in her afternoons in the garden and hear

positive comments.
The system supports the user to explore others' vegetable gardens, photos and posts, even from people she don't know. In particular they can access a graphical representation of her garden and see the details of what she is growing. If she find an interesting user, she can follow him and see his photos and posts in a dedicated feed (in this way they don't miss anything they are doing). Experienced users can show others what they are doing or how they are approaching a problem and inexperienced users can learn from them or discover new ideas and solutions for their vegetable garden.
With this app Sophia shares a lot of photo from her garden and receive a lot of compliments. Even her colleagues installed it just to follow her. They said that she is inspiring them and sooner or later they would start a vegetable garden. Many users reach her by asking for advice and she is please to teach them.

2.4.2 Scenario 2: Jackson family

The Jackson family enjoy doing outdoor activities together such as trekking in nature or gardening. There are three family members: Jack (9 years old), Paul (35) and Lisa (33). This year they decided to start a vegetable garden, but unfortunately none of their friends has one. On the internet there is too much information and they don't even know where to start. They would love to know someone experienced who they can learn from.
The system supports the user to explore others' vegetable gardens, photos and posts, even from people they don't know. In particular they can access a graphical representation of their garden and see the details of what they are growing. If they find an interesting user, they can follow him and see his photos and posts in a dedicated feed (in this way they don't miss anything they are doing). Experienced users can show others what they are doing or how they are approaching a problem and inexperienced users can learn from them or discover new ideas and solutions for their vegetable garden.
With this app the Jackson family discovers Sarah, who is an influencer in this social network. A lot of people follow her and learn from what she is doing. Lisa is becoming an expert to tie tomatoes to the poles with Sarah's technique. Paul periodically updates their virtual garden on the app and Jack loves to take a lot of pictures of the vegetable garden when their parents work on it. Every day they decide what is the best photo and they post it on the app.

2.5 Navigation map

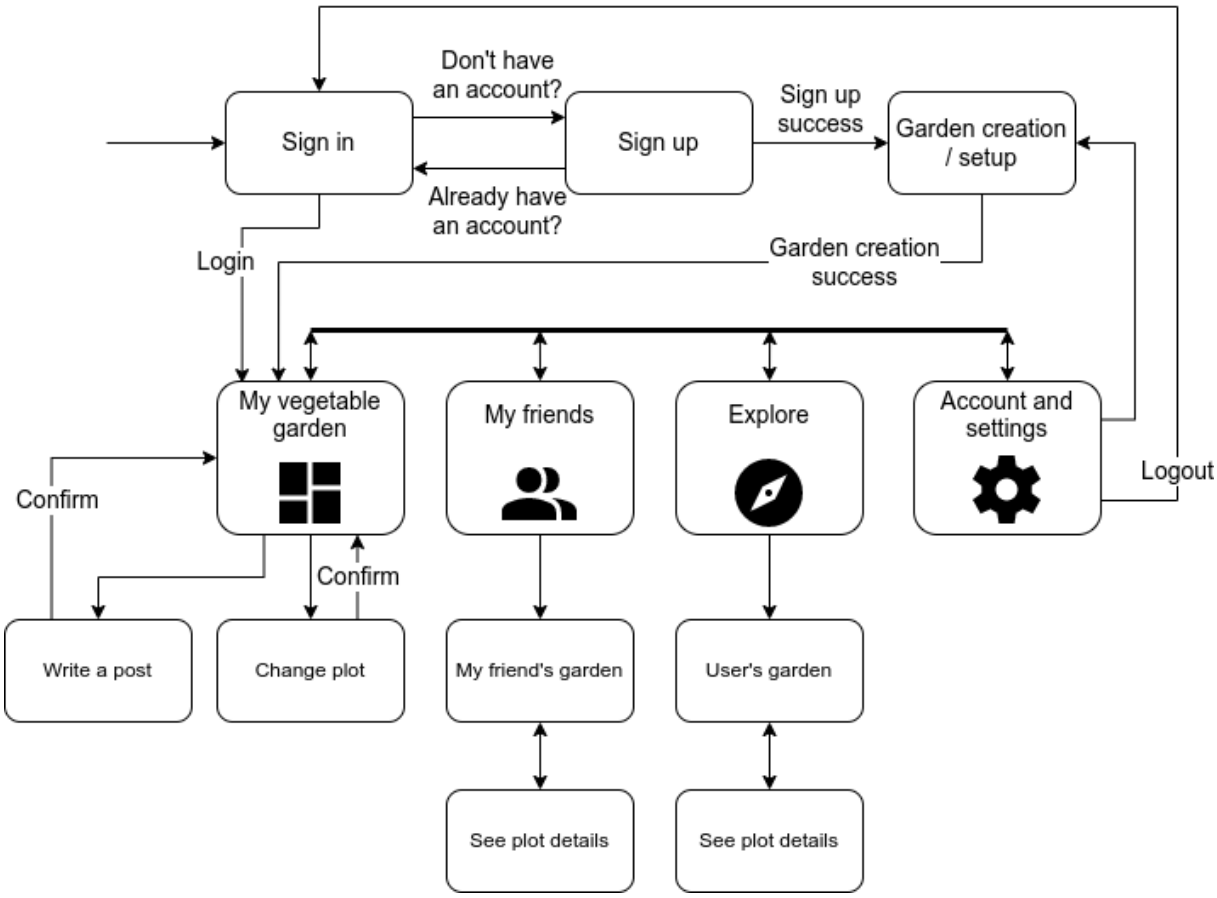


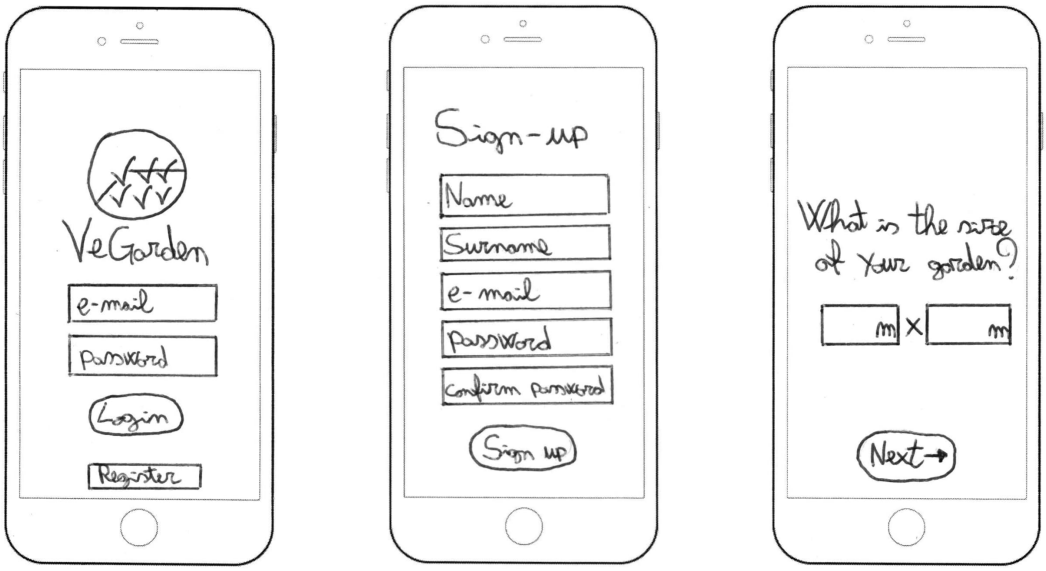
Figure 2.1: Navigation map of the prototype.

In figure 2.1 it is possible to see the navigation map of the prototype that I designed. When the user opens the app for the first time a *sign-in* page will be showed. If the user is already registered it can insert his credentials and login, otherwise he can go to the *sign-up* page. Once registered a wizard page will help the user creating his garden and when he his done the *My vegetable garden page* will be displayed. The main page contains four buttons that link to different screens. The default page shows the user's garden and his posts. From this screen he can also uploads a photo or write a post. He can also interact with his virtual garden: he can change the crops he planted in a particular area of his vegetable garden, he can set other interesting properties (e.g. the number of plants, the date of sowing, etc.) or he can write some useful notes. The second page shows the posts of the user's friend. In this page he can reach also to their friends' vegetable gardens (but he will not be able to change them). A very similar section is the *explore page* where the user can discover interesting people and also

follow them. The last main section is the page that let the user to change the settings of the app, e.g. he can change the size of his virtual garden, he can logout form his account or he can change his profile image.

2.6 Paper prototype

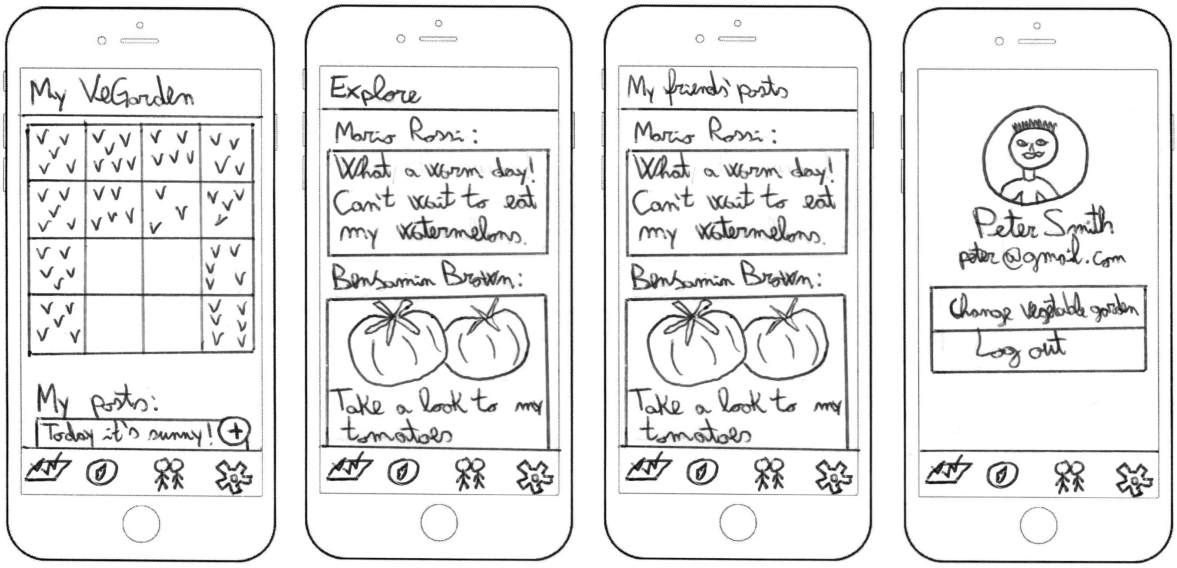
Starting from the navigation map I realized a non-interactive paper prototype.



(a) Login page. (b) Sign-up page. (c) Vegetable garden creation/setup.

Figure 2.2: The first three screens of the app.

The login page (figure 2.2a) is pretty minimal: it shows the icon of the app, its title and two forms for inserting email and password of the user. A login button will check the user credentials and bring the user to the main page. The sign-up page (figure 2.2b) asks for name, surname, e-mail, password of the user. A confirm password form has been added in order to make sure the user doesn't make a typo while inserting his password. Just after the registration the app will ask the user what is the size of his vegetable garden, as showed in figure 2.2c. The user should specify the dimension of his garden (e.g. 15 m $\times$ 8 m). Based on this information, the app will create the virtual representation of his garden.



(a) My VeGarden. (b) Explore. (c) My friend's posts. (d) Account and settings.

Figure 2.3: Main page and the four screens.

Figure 2.3 shows the four screens that belongs to the main page. A bottom navigation bar allow the user to switch between the pages. *My VeGarden page* (figure 2.3a) contains two important elements: the digital representation of the user's vegetable garden and his posts. A floating action button in the bottom right corner let the user create a post. Figures 2.3b and 2.3c are very similar: they both show posts of other users. While the first one shows just the posts of the friends of the logged user, the second one shows the posts of every user of the platform. If the user taps on the creator of a post, the app will show the vegetable garden and the posts of the user. From this page it will also be possible to follow the user. The *account and settings* page (2.3d) shows some information about the logged user, and allows to change the profile image. A logout button will redirect the user to the *login page*. From this page it is also possible to change the size of the vegetable garden: it will show again the page in figure 2.2c and the digital representation of the vegetable garden will change to reflect the new dimensions.

(a) Plot details. (b) Write a post page.

Figure 2.4: Two important screens the user can reach from *My Vegarden* page.

Starting from *My Vegarden* page the user can reach other two important pages. If he taps on a certain plot of the vegetable garden he can change all of its properties (figure 2.4a), such as: the crop, the sowing date, the number of plants and he could also add extra notes. All these properties are optional.
The *write a post* page (figure 2.4b) is very simple: it contains a multiline form where the user can insert the text of the post and a floating action button to confirm and post what he has written.

Chapter 3

App development

In this chapter it will be detailed some of the technical choices that I made during the development of the app. I try to replicate as much as possible the paper prototype but in some case there are few differences.
I heavily relied on Firebase for this project, in particular I used auth for the authentication, firestore for the database and storage for storing photos (profile pictures and photos from posts).
I used Kotlin for the development and the app has been translated in both English and Italian.
In figure 3.1 it is possible to see the final navigation map of the app. It is worth noting that there are few differences from the navigation map in figure 2.1. All the variations will be explained in this chapter. There are also many activities/fragments that have the same name, that is because a lot of code is shared across multiples screens with just few differences.

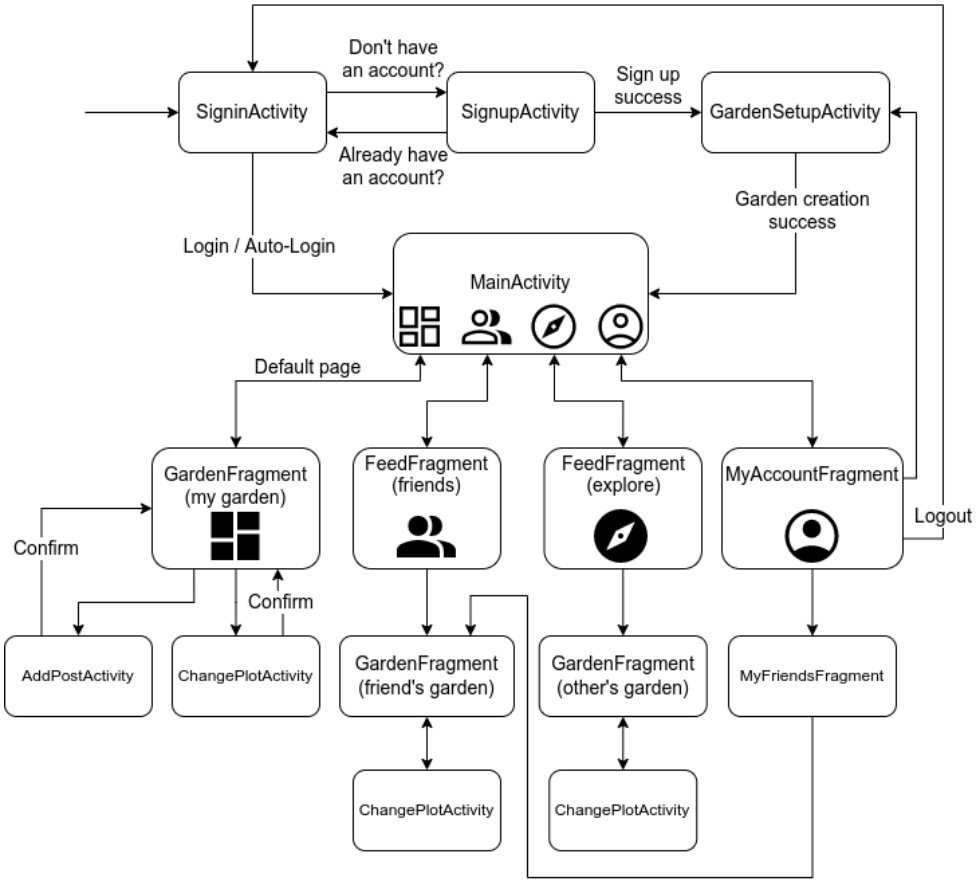
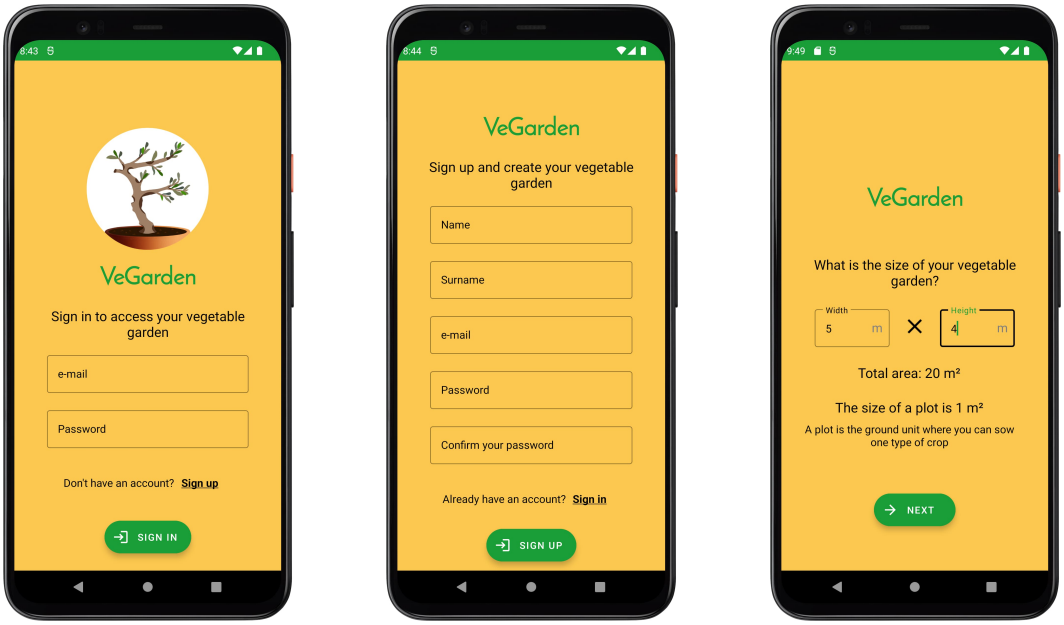


Figure 3.1: Navigation map of the app.

3.1 Sign-in, Sign-up and Garden Setup



(a) Login page. (b) Sign-up page. (c) Vegetable garden creation/setup.

Figure 3.2: The first three screens of the app.

As showed in figure 3.2a and 3.2b, the user can move between the two pages by interacting with the underlined text. I used this style because it is the same as the links in websites. The clickable area of the text is much wider than the text itself in this way it should be easier for the user to tap on it.

From this firsts screens it is already possible to see the color choices that I made. I choose just two colors for the app: green and yellow. They recall the colors of vegetation at different stages of plant maturation. I also used a custom font for what concerns the title of the app.

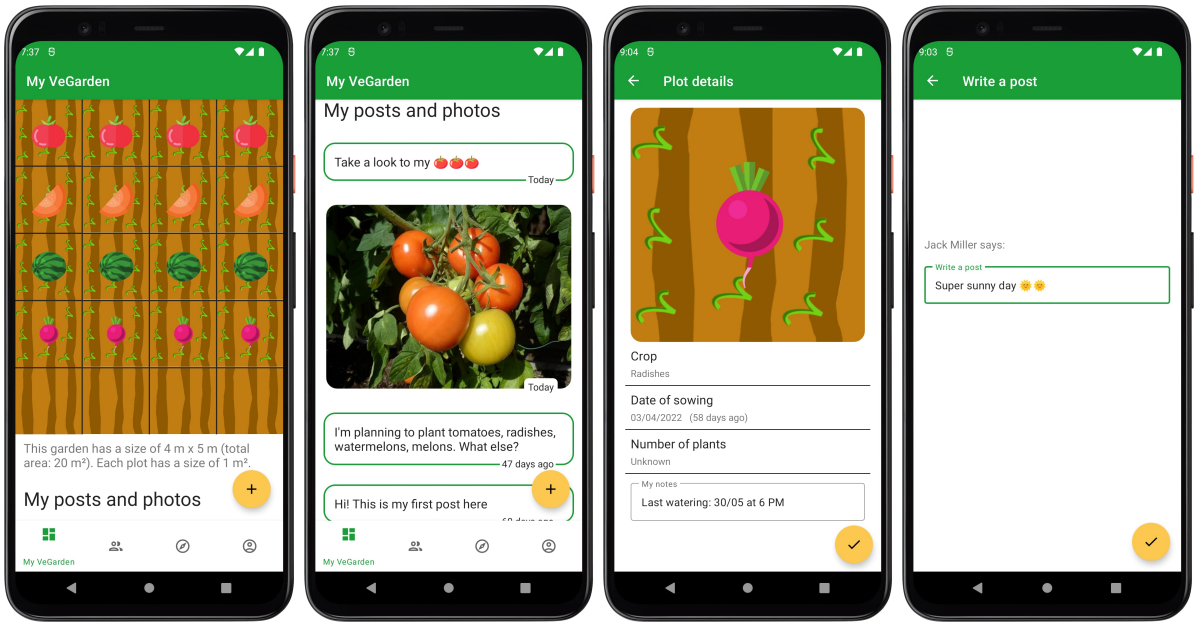
Inside the code of the login screen I wrote an auto-login mechanism. If the user has already performed the login previously it will be redirected to the `MainActivity`.

All the forms in these pages will check the correctness of the inserted text. For example, the password should be at least eight characters, the email must be valid, the two passwords in the registration page must be the same, and the name and surname fields should not be empty.

Once the user signed-up, the app will show the vegetable garden creation page (figure 3.2c). This page asks the user what is the size of his garden in order to generate its

virtual representation. While the user insert the size of the garden, the app will compute the area of the garden, in this way the user can double check the information he submitted. At this stage the app explains the user another important concept: the plot of the garden. The plot size changes automatically depending on the size of the field. Once the user confirms all of this information the app will create all the plots on the database and saves all the information the user submitted.

3.2 My VeGarden and related pages



(a) My VeGarden.

(b) My posts. It is the same page as figure (a).

(c) Plot details.

(d) Write a post.

Figure 3.3: My VeGarden page and write a post.

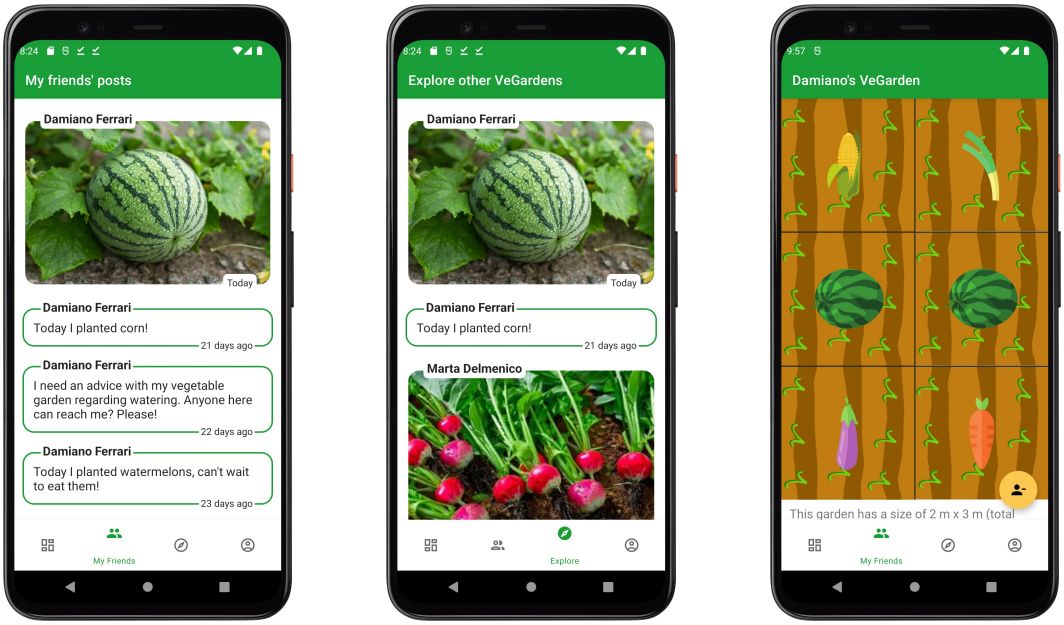
In figure 3.3a and 3.3b it is showed all the content of the user. It contains a digital representation of his garden and his posts. The vegetable garden is generated automatically from code starting from the dimension inserted by the user. It is a `LinearLayout` with a vertical orientation which contains several `LinearLayout` with an horizontal orientation, each containing a plot (a clickable `ImageView`). This representation is arranged so that the largest dimension of the vegetable garden is always the height in order to ease the visualization on smartphones. For example, a garden with size 5 m $\times$ 4 m is the same as a garden with size 4 m $\times$ 5 m and it will always have five rows and four columns.

It is possible to see immediately what the user has planted in a certain plot. If the user taps on a plot it will be showed the details of that plot as showed in figure 3.3c. He will be able to change them and save the plot with the bottom right floating action button.

Figure 3.4: Speed dial for post creation.

If the user scrolls down in his *VeGarden page* he could see a short description of his garden (also this one is generated automatically) and all of his posts and photos. They are arranged in a `RecyclerView`. It is nice to notice that all the posts has a user friendly timestamp that uses labels such as “Today”, “Yesterday” and “X days ago”. This is a very important information I added over the prototype. All the posts are stored in Firestore and images have a link to Firebase storage. The photo posts are displayed with an external library called Picasso [3].
In the prototype I haven’t thought in detail how to create posts, whether written or a photo. In the implementation I used a speed dial: when the user taps on the floating action button showed in figure 3.3a two options will be displayed to the user as showed in figure 3.4. If the user taps on “Write a post”, he will be redirected to the paged showed in figure 3.3d, otherwise he will be redirected to the Android image picker in order to post a photo. In implemented this mechanism by using [4].

3.3 Other users: posts and gardens

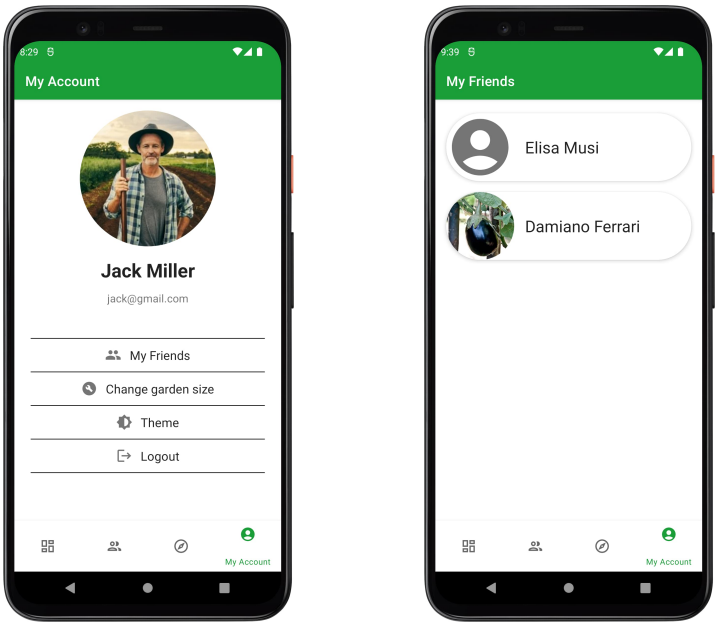


(a) My friends' posts. (b) Explore page. (c) Friend's profile.

Figure 3.5: Interaction with other users of the platform.

In figures 3.5a and 3.5b it is possible to see other two interesting `fragments`. They seems very similar and in fact they are implemented in code with just one fragment. But the first one shows the posts just from the people the user follows, while the second one shows the posts from all the user of the platform. These pages use the same `RecyclerView` that was already implemented for *My VeGarden page* with just a small difference: the name of the user who submits that post. If the user taps on the name of a user he will be redirected to his garden (figure 3.5c). This time he could just see it (even the plot details), in fact he will not be able to change it. With the bottom right floating action button he will be able to follow/unfollow him. This `fragment` is the same used to implement *My VeGarden* page, in this way many code has been reused.

3.4 My account and settings



(a) Account and settings page.

(b) Friends list.

Figure 3.6: Settings and related pages.

In figure 3.6a it is showed the last `fragment` that belongs to the `MainActivity`. This is quite different over the prototype because there are more options. In this page the user can see all his personal details: his name and surname, the email he used, his profile picture (he can change it by tapping on it) and a list of his friends. From this page the user can also change the theme of the app (light, dark or system default), logout or change the vegetable garden size. If he taps on this button a warning will tell the user that he will lose all the data he inserted in the vegetable garden. If he accept, the garden setup page will allow the user to setup the new dimension as showed in figure 3.2c.

If the user wants to see a list of all the users he follows he can tap on the “My Friends” button and the friends list will appear (figure 3.6b). This page is just another `fragment` with a `RecyclerView`. If the user taps on a friend he will be able to see his vegetable garden as described in the previous section. This page did not exist in the prototype, but I added it because if it did not exist, there would be no way for the user to know who he is friend with.

In the screenshots of this chapter it is possible to notice that the icons of the bottom

navigation bar change depending by their state. When the user taps on an icon it changes its color, it fills up and a description label appears.

3.5 Dark theme

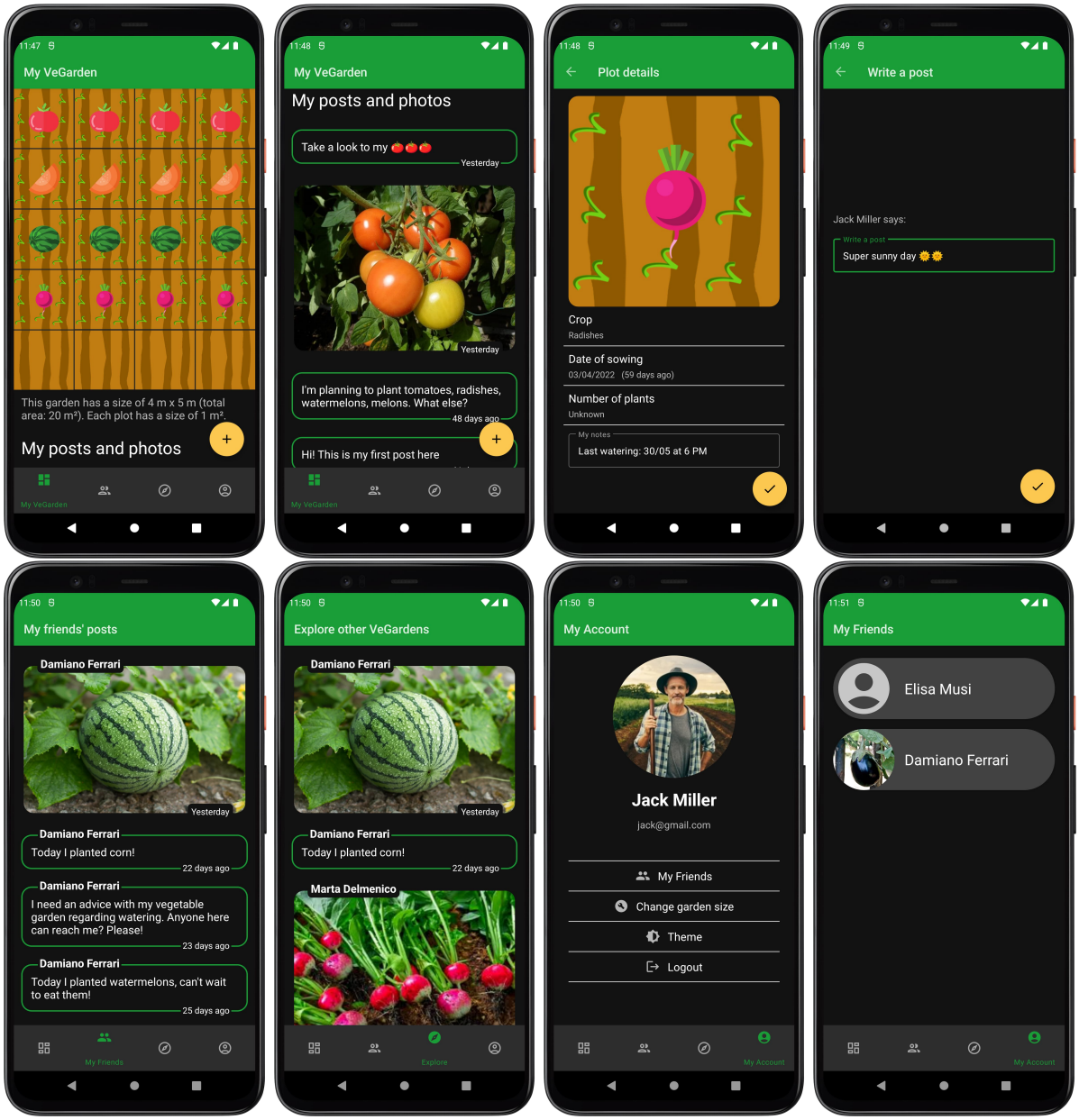


Figure 3.7: App pages with dark theme enabled.

As aforementioned, the app supports both light and dark theme. It is possible to changed it from app settings, otherwise the app will follow the same theme of the system. A system dark mode is supported since Android 10. In figure 3.7 it is possible to see some of the pages of the app with dark mode enabled.

Chapter 4

Database structure

The app, as a system that enables the communication between different users, needs a database. As aforementioned I used Firebase Cloud Firestore, which is an online non-relational database that provides APIs for multiple programming language (including Kotlin) with an easy configuration. In figure 4.1 it is possible to see the UML diagram of the structure of the database.

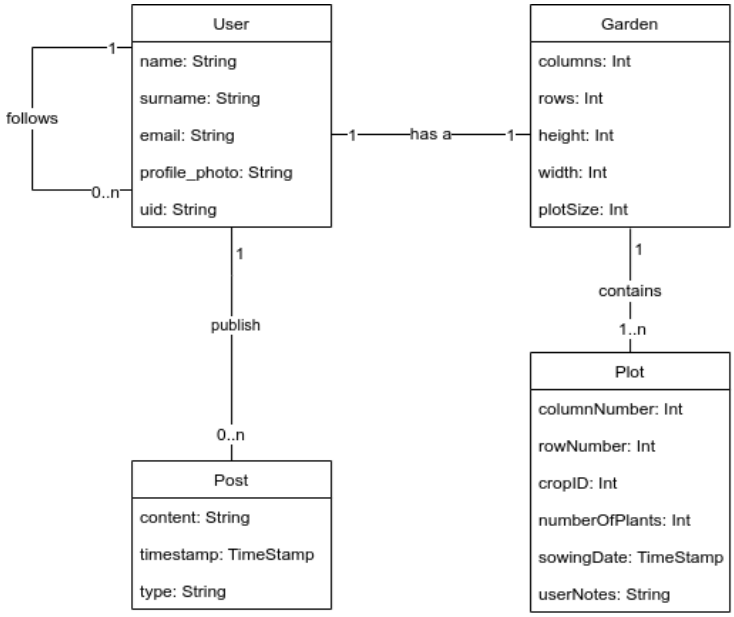


Figure 4.1: Database structure.

Let's analyze some of the most interesting parts of the diagram. A user has a `profile_photo` attribute which at the beginning is just `null` and when a user uploads his picture it will be the URL of the resource within Cloud Storage.
A post has a `type` attribute which can take two possible values: "post" (if it is a text post) or "photo" if the user uploads a picture. And the "content" will be the text the user

writes in case of a written post or the URL of the resource within Cloud Storage if the users uploads a picture.

In order to implement this structure in a non-relational database I implemented three main root collections:

1. Users, which contains a document for each user. The “follows” relation has been implemented with `myFriends` attribute which is a list of UIDs of followed users.
2. Posts, which contains a document for each post, a `uid` attribute has been used in order to link the post to the user who publish that post.
3. Gardens, which contains a document for each garden. Every garden contain a `plots` collection which carries a document for each plot.

Bibliography

[1] URL: https://trends.google.it/trends/explore?cat=18&date=all&q=%2Fg%2F11cknh9qp1.

[2] URL: https://trends.google.it/trends/explore?cat=18&date=all&q=%2Fm%2F018325.

[3] URL: https://square.github.io/picasso.

[4] URL: https://github.com/leinardi/FloatingActionButtonSpeedDial.